

al fisheries have endeavoured to travel further and further south in search of their catch. During 1996 and 1997 New Zealand commercial fishing vessels began investigating the feasibility of fishing the Ross Sea for Antarctic toothfish, *Dissostichus mawsoni* (Ainley et al., 2008). Toothfish is unusual and expensive and can be called by a variety of names including Chilean Sea Bass and Antarctic Cod. It is a high end luxury product, not one of necessity, and not one that can be guaranteed to be harvested sustainably. The initial exploration experiment has since ended; however each year since 1999 the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), has raised the catch limits, with catch sizes and the number of countries sending vessels to the southern most parts of the ocean continuing to increase (Ainley, 2004). This is clearly evident in CCAMLR's statistical bulletin (CCAMLR, 2009) which indicates that in 1999 751 tonnes of *Dissostichus mawsoni* was caught compared to 3,617 tonnes in 2009.

Marine Protection in the Ross Sea

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At the bottom reaches of the earth lies an ecosystem still largely untouched by humans. The Ross Sea continental shelf ecosystem is found 155 degrees west longitude lying adjacent to the Antarctic continent, with depths less than 3,000 metres, it stretches over almost a million kilometres (Hance, 2010). Its beautiful, rich and abundant nature somewhat protected from human exploitation by its extensive sea ice, brutal weather, and remote environment. Marine animals including killer whales, sea-birds, penguins, whales, giant fish and species not found elsewhere in the world continue to thrive and exist with limited manmade disturbance. Natural processes, species interaction, interconnections, food-webs, complexities not yet understood and other unknown mysteries abound. For this reason the establishment of a marine protected area (MPA) has recently been proposed by the Antarctic and Southern Ocean Coalition (ASOC). This follows suggestions by the World Summit for Sustainable Development, and the 5th World Parks Congress to establish a global and representative network of marine protected areas by 2012 (ASOC, 2010). This article will look at the Commission and the Convention currently governing fishing in the Ross Sea, as well as at the MPA proposal put forward.

Fish for science or profit

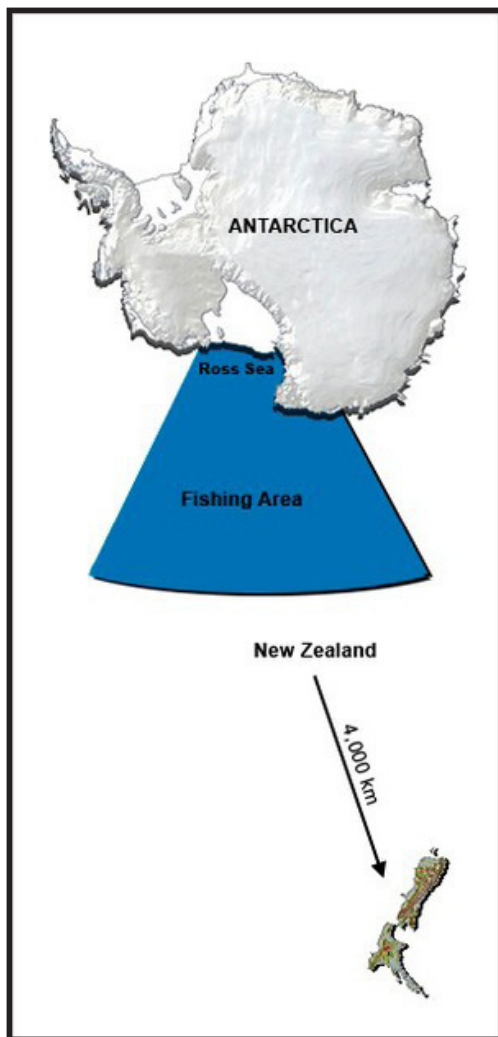
The Ross Sea has been described as the 'last ocean' and the 'last living laboratory' currently allowing scientists an opportunity to research the workings of an intact ocean ecosystem (The Last Ocean Charitable Trust, 2010). Mineral and oil extraction is prohibited in the Ross Sea under the Antarctic Treaty, fishing however is not (Hance, 2010). It has been suggested (Myers & Worm, 2003) that humans have already eaten their way through

Ross Sea Governance

In 1980 the Convention on the Conservation of Antarctic Marine Living Resources, an instrument of the Antarctic Treaty System, was concluded in Canberra with New Zealand one of the original signatories (New Zealand Ministry of Foreign Affairs and Trade, 2010). In 1982 the Convention came into force and remains applicable to all marine living organisms between the Antarctic Convergence and south of 60 degrees south latitude. The Antarctic Marine Living Resources Act (1981) incorporates the Convention into New Zealand's legal system. It is through this Convention that a Commission known as CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources) was initially established, of which New Zealand is a founding member (New Zealand Ministry of Foreign Affairs and Trade, 2010). The management and protection of marine living resources south of the Antarctic Convergence, including the Ross Sea, is the responsibility of the Commission. In New Zealand the Minister of Foreign Affairs is accountable for Antarctica and New Zealand's participation in the Antarctic Treaty system in which CCAMLR is a fundamental component (New Zealand Ministry of Foreign Affairs and Trade, 2010). [See map on following page]

Precautionary Measures

The CCAMLR Convention's objectives and conservation principles dictate harvesting in the Convention Area. Currently CCAMLR regulates crab, squid, lantern fish, mackerel icefish, Patagonian toothfish, Antarctic krill, and Antarctic toothfish fisheries in the Southern Ocean of which the Ross Sea is a part (Greenpeace, 2010). CCAMLR's precautionary and ecosystem based approach to fisheries management has earned them a well renowned reputation for international leadership. Their management practices require the whole ecosystem be taken into consideration, as opposed to just the species being



caught in the CCAMLR area. Catches and shipments of toothfish are required to carry valid catch documentation to indicate CCAMLR conservation measures of compliance (New Zealand Ministry of Foreign Affairs and Trade, 2010). In New Zealand all landings, imports and exports require toothfish to be accompanied by valid catch documentation. While such measures are in place to monitor catches, they have been insufficient in stopping illegal, unlicensed, and unregulated fisheries entering the Ross Sea. New Zealand is responsible for carrying out surveillance against such fisheries in the CCAMLR Convention Area while also monitoring licensed vessels' compliance with conservation measures.

New Techniques

What initially attracted the fishing industry to some of the most dangerous and distant waters on the planet can be linked to the introduction of new longlining fishing techniques (Greenpeace, 2010). These new techniques, allowing fishing vessels to operate in far deeper and rougher water than ever before, gave rise to the rapid expansion in the toothfish fisheries in the late 1990's. A typical longline is usually around 1,000-1,200 metres in length and has between 950-1,200 hooks. Longlines are baited by machine and typically each vessel sets and retrieves 10,000-40,000 hooks a day, equal to about 15-50 kilometres of longline (Greenpeace, 2010). In 2003-04 the legal quota for Patagonia toothfish may have been first realised, with an estimated three times this taken in illegal efforts (Ainley, 2004). The legal limit had been set at 3,625 mega tonnes equating to 75,000 voracious predatory fish, based on each fish weighing an average of 50 kilograms. These human sized predators slow to grow and mature, some as old as 50 years, are slow to be replenished. The repercussions of removing large numbers of these creatures from the Ross Sea continental shelf ecosystem are not yet completely understood.

targeted. Decisions regarding fishing in the Southern Ocean should ensure any risk of long-term negative effects caused by the fisheries on the ecosystem are mitigated. CCAMLR requires fisheries operating in its waters to carry an independent observer to ensure the vessels are adhering to fishing regulations. It is under the Antarctic Marine Living Resources Act (AMLR) (1981) that New Zealand fisheries are granted permits to take marine organisms in the Convention Area, with allocation the responsibility of the New Zealand Minister of Fisheries.

Permits Required

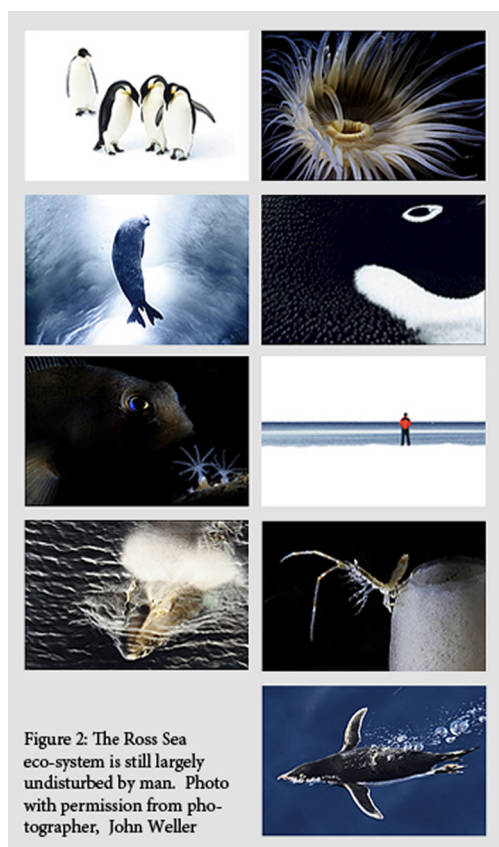
To be able to operate in the CCAMLR area New Zealand flagged vessels must hold a high seas fishing permit issued under the Fisheries Act (1996), as well as obtain an AMLR permit from the Ministry of Fisheries. At the annual CCAMLR meeting the extent of New Zealand's participation in the CCAMLR fisheries is determined (New Zealand Ministry of Foreign Affairs and Trade, 2010). New Zealand is then able to authorise fishing to the level at which the Commission agrees.

In 2000 CCAMLR began operating a Toothfish Catch Documentation Scheme. All contracting parties are bound to the scheme designed to track landings and trade flows of toothfish



Figure 1: The unique environment of the Ross Sea. Photo with permission from photographer, John Weller

The CCAMLR Antarctic toothfish total allowable catch limits are based on a precautionary catch limit approach. This approach has seen CCAMLR allow for the Ross Sea toothfish to be fished to within 50% of its pre-exploitation biomass over the next 35 years (NIWA, 2008); however a precautionary model has already predicted that up to 85% of the Patagonia toothfish pre-fished stock has already been reduced by fishing.



The Theory of Maximum Sustainable Yield

In her book *The World is Blue* (2009), Sylvia Earle, a respected Marine Scientist, discusses the theory of Maximum Sustainable Yield (MSY). MSY is a strategy developed in the 1930's to extract the largest possible catch from a stock of fish over an indefinite period of time. The theory is based on the idea that a population will reproduce at its maximum efficiency when reduced to half that which can be sustained in a given area. Computer models base calculations on fish numbers predicted to have been present before fishing began. Earle (2009) breaks down the concept of MSY into twelve assumptions, facts, and flaws. Within these the mysteries of population fluctuations and life histories and the difficulty of predicting fish numbers prior to when fishing began are alluded to. She criticises the theory's regard for fish foremost as a commodity rather than as integral parts of intact ocean ecosystems. She explains the realities of bycatch when using longlining methods to target a particular species and the problems which occur when the first of the target species caught are the oldest, largest and often most productive fish. Perhaps most striking is the claim that people who want to believe that maximum sustainable yield works, keep on believing that it works, even when experience repeatedly indicates that it does not.

Marine Protected Area Proposal

The Ross Sea continental shelf ecosystem is arguably one of the most pristine stretches of ocean left on the planet. Concerns have arisen for the ecosystem and its food-web as it comes under increasing pressure from commercial and illegal fishing interests. As the environment begins to experience irreversible alteration from climate change and anthropogenic activity, a proposal to establish a marine protected area (MPA) was submitted to CCAMLR in September 2009 by the Antarctic and Southern Ocean Coalition. This followed suggestions by the World Summit for Sustainable Development, and the 5th World Parks Congress to establish a global and representative network of marine protected areas by 2012 (ASOC, 2010). It is believed that if the Ross Sea was closed to fishing and protected as a marine reserve it would give the ecosystem a chance to recover from fishing impacts already beginning to emerge. The natural reserve created would set aside the Ross Sea as an area dedicated solely to science and peace (Greenpeace, 2010).

The benefits of marine protected areas are well documented and covered extensively throughout marine literature (World Commission on Protected Areas, 1999, Department of Conservation, 2005, & Earle, 2009). CCAMLR and the Antarctic Treaty Consultative Parties have both identified the Ross Sea as one of 11 priority areas to be included in the development of the global marine protected area network. However questions remain on whether a marine protected area would be sufficient to tackle the problem of illegal fisheries in the Convention Area and over who will be responsible for enforcement.

To bring the unique values of the Ross Sea to people's attention a dedicated group established The Last Ocean Charitable Trust (2010). The Trust is working closely with a variety of other projects intended to help raise general awareness, including the Last Ocean documentary currently in production by award winning kiwi filmmaker, Peter Young. Stunning imagery, combined with meaningful interviews, will make this documentary a powerful tool for introducing the Ross Sea and the MPA proposal. John Weller, Ross Sea conservation photographer, is also using images captured from the Ross Sea as he showcases his Last Ocean photography for free in public spaces around the world. The issue is beginning to gain momentum as presentations take place on different scales and publications begin to pick up on the story.

Conclusion

With a landscape as picturesque and abundant as the Ross Sea continental shelf eco-system it is no wonder that emotions run high. New techniques make fishing in the Ross Sea possible but clarification is needed on whether or not fishing in the Ross Sea is appropriate and able to be carried out sustainably. Moving forward CCAMLR is faced with the decision as to whether it is best to set aside the Ross Sea as a marine protected area designated solely to research, or whether to continue to allow and possibly expand a global fishery. The uncertainty of supply, combined with the unknown implications of removing the Antarctic toothfish from the Ross Sea food web, make this a decision that cannot be made lightly.

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